

Emerging Contaminants: What's in Your Water?

By Fethi BenJemaa and Fawzi Karajeh

Emerging Contaminants, Xenobiotics, Endocrine Disruptors, Endocrine Active Chemicals, Pharmaceuticals and Personal Care Products, Hormonally Active Agents, Persistent Organic Pollutants, Bioaccumulative Chemicals of Concern...And the list goes on. These are some of the many terms that we hear and read about more and more lately; such terms are either synonymous or describe some intersecting sets of a plethora of chemicals and pollutants. They are a new class of chemical pollutants and toxins that managed to spread into the environment, making their way into streams, lakes and groundwater. Even though such pollutants have only gained attention in recent years, they most likely have been present in the environment for a long time.

The main origins of these contaminants are personal care products (fragrances, deodorants, disinfectants, cosmetics, sun screens, and insect repellants), various pharmaceutical products (prescription and over-the-counter drugs, antibiotics, and diagnostic agents), detergents, cleaning agents, household chemicals, agricultural fertilizers, pesticides,



fungicides and animal growth hormones. The universal and widespread use and subsequent discharge of such products on a continuous basis further exacerbate their persistence in our waters. A monitoring study conducted by the U.S.

Geological Survey during 1999 and 2000 of 139 streams in 30 states, including several in California, found small amounts of such emerging contaminants in 80 percent of surface water samples. Many of these contaminants are associated with municipal, industrial, and agricultural wastewaters. As such pollutants are easily transported into the environment through various ways, the issue of emerging contaminants is of paramount importance not only to the wastewater and water recycling community but also to the water supply, environmental ecology, and public health communities.

These emerging contaminants are of growing concern as some even at trace concentration levels, could alter the physiological responses and the endocrine and reproductive systems in humans and

Continued. See "Contaminants" on page 11

Contaminants

(continued from page 9)

animals by mimicking natural hormones. Potential adverse effects include reproductive impairment and disorders, cancer, and other unknown toxicity effects that are yet to be discovered and understood. The toxicological significance of these trace contaminants can be intensified by their additive effects (simultaneous exposure to a multitude of agents) as well as their possible interactive effects.



Even though there are currently no regulations governing the monitoring of pharmaceuticals and other emerging contaminants in water, the California Department of Health Services has already proposed draft regulation language requiring monitoring for the occurrence of nonregulated chemicals in water intended for groundwater recharge. (DHS Groundwater Recharge Reuse Regulations, July 2003 Draft, section 60320.040. Control of Nonregulated Chemicals). The unregulated chemicals that DHS requires monitoring are those that lack drinking water standards but nonetheless require

analysis and are found in Title 22 of the California Code of Regulations section 64450, effective January 3, 2001. These include inorganic chemicals (Boron, Chromium-6, Perchlorate, and Vanadium) and organic chemicals (Dichlorodifluoromethane, Ethyl tertiary butyl ether, Tertiary amyl methyl ether, Tertiary butyl alcohol, and 1,2,3-Trichloropropane).

Conventional water treatment technologies currently available may not be effective for the removal of all emerging contaminants. Advanced membrane processes such as reverse osmosis (RO) and nanofiltration (NF) offer the best available treatment alternatives. However, additional research and data are needed to determine the effectiveness of different water treatment technologies including RO and NF in removing such trace chemicals. DWR, in order to understand the fundamentals and the factors driving rejection of contaminants of concern

in membrane treatment systems, is participating in a study aimed at developing a standardized bench-scale testing protocol for organic micropollutant rejection considering different water quality matrices and membrane operational conditions. The study will also evaluate the viability of NF and new low pressure RO membranes for rejecting unregulated and regulated organics as well as nitrogen under a range

of experimental conditions at the bench-, pilot-, and full-scale.

DWR's study partners include West Basin Municipal Water District, AWWA Research Foundation, WaterReuse Foundation, Colorado School of Mines, the University of Colorado, and Koch Membrane Systems.

Additional resources and information on emerging contaminants can be found at the U.S. EPA National Exposure Research Laboratory Web site at www.epa.gov/esd/chemistry/pharma/index.htm and the U.S. Geological Survey Toxic Substances Hydrology Program at <http://toxics.usgs.gov/index.html>.